

pore structure is provided which is formed on a polymer compound containing a sequence of two or more adjacent methylene groups in a molecular structure of the repeating unit of the polymer compound.

5           The surface of the polymer compound may be a surface of a Langmuir-Blodgett film of the polymer compound.

          The polymer compound is preferably oriented, more preferably uniaxially oriented.

10           The mesostructured thin film contains silicon, specifically silica. The mesostructured thin film is formed preferably by hydrolyzing a silicon alkoxide.

          The mesostructured thin film is formed preferably by hydrolysis reaction in the presence of a  
15   surfactant.

          The mesostructured thin film preferably has a hollow structure.

          The surface of the polymer compound is subjected preferably to rubbing treatment before the  
20   formation of the mesostructured thin film.

          The rubbing treatment is conducted preferably in a direction perpendicular to mesochannels of the mesostructured thin film to be formed.

          The number of a sequence of adjacent methylene  
25   groups in the repeating unit of the polymer compound preferably ranges from 2 to 20.

          The sequence of adjacent methylene groups in

isoelectric point of  $\text{SiO}_2$ ) by mixing an acid such as hydrochloric acid. The surfactant is suitably selected from cationic surfactants such as quaternary alkylammonium salts, and nonionic surfactants having a hydrophilic group such as alkylamine and polyethylene oxide. The length of the molecule of the surfactant is selected suitably depending on the intended pore diameter of the mesostructure. An additive such as mesitylene may be added for increasing the micelle diameter of the surfactant.

The  $\text{SiO}_2$  precipitate is formed at a lower rate under acidic conditions, especially near the isoelectric point thereof, although the precipitate is formed instantaneously under basic conditions on addition of the alkoxide.

The substrate employed in the present invention has a thin film of a polymer compound formed thereon and subjected to rubbing treatment. The base material for the substrate for forming the polymeric film is not specially limited, the material including silica glass, ceramics, and resins.

The rubbing treatment is conducted by rubbing with cloth the polymer coat having been formed on a substrate by spin coating or a like coating method. Usually, the rubbing cloth is wound on a roller, and the rotating roller is pushed against the surface of the substrate.

mesoporous silica.

The solvent extraction for the removal of surfactant micelles employed in this Example is effective for removing the surfactant from a silica mesocomplex thin film formed on a substrate having less resistance to heat treatment in an oxidative atmosphere, although the solvent extraction is not suitable for complete removal of the surfactant.

The formed mesoporous silica thin film was subjected to in-plane X-ray diffraction analysis as in Example 1 to determine the uniaxial orientation of the mesochannel in the thin film from the in-plane rotation dependency of (110) plane diffraction intensity. The obtained profile had the same half width as that before the surfactant extraction. This shows that the mesoporous silica thin film could be obtained also by the solvent extraction with the uniaxial orientation retained.

### Example 3

In this Example, a silica mesocomplex thin film, and a mesoporous silica thin film were formed on a substrate having a coat of a polymer compound thin film containing a sequence of 17 adjacent methylene groups in the repeating unit in the side chain of the polymer compound and having been subjected to rubbing treatment.

On a silica glass plate having been

polyethylene oxide as the hydrophilic group makes it possible to control the pore diameter in a wide range in comparison with the use of an alkylammonium type of cationic surfactant.

5           As shown in the above Examples, a mesocomplex thin film, and a mesoporous thin film can be formed with high continuity and high uniaxial orientation on the substrate which has a thin film of a polymer compound having a sequence of two or more adjacent  
10 methylene groups in the repeating unit and has been subjected to rubbing treatment, or on the substrate which has an LB film of a polymer compound having a sequence of two or more adjacent methylene groups in the repeating unit.

15           According to the present invention, an excellent mesostructured thin film can be realized and produced.